Design Memorandum No. 02-02

TO: Engineering Offices and Divisions
Districts
Consulting Engineers

FROM: Kenneth Birst, Design Engineer

DATE: May 7, 2002

SUBJECT: SHOULDER RUMBLE STRIP GUIDELINES

Design Manual Reference:
Section III-06.04

__°__ Revision
____ Supplemental

Introduction

This Design Memorandum establishes guidelines for placement of shoulder rumble strips on rural state highways, including: Interstate highways, multilane divided and undivided highways, and two-lane highways. Rural is defined as roadway segments that have minimal residential or commercial development and little or no further development is anticipated in the near future.

Implementation

These guidelines shall be in effect for all projects with a scheduled bid opening date after June 14, 2002. District personnel should make every effort to implement these guidelines for projects which have been bid prior to June 14, 2002, and on which shoulder rumble strip construction has not yet begun.

Purpose

To provide shoulder rumble strips to reduce run-off-the-road (ROR) crashes and prevent a drowsy or inattentive driver from traveling very far onto the shoulder and possibly striking a parked vehicle, a bicyclist, a pedestrian, or maintenance personnel. Additionally, the shoulder rumble strips may serve as a means to guide motorists and maintenance operators during inclement weather conditions when striping visibility is poor.

Guidance

Shoulder rumble strips will be installed on the following highways as defined in the NDDOT Highway Classification and Performance Guidelines:

- All Rural Interstate highways.
- Interregional highways with shoulder widths of 4 feet or greater.
- State Corridor highways with shoulder widths of 4 feet or greater and the average daily traffic (ADT) is 2,000 or greater.

Shoulder rumble strips may be considered on other highways at locations that have high ROR crash rates, provided there is adequate shoulder width to receive the rumble strips. The Planning and Programming Division - Traffic Operation Section will make recommendations regarding the crash analysis. The District Engineer will make recommendations regarding the structural adequacy of existing shoulders and slough to receive rumble strips.

Shoulder rumble strips will be installed in conjunction with rural highway projects where paved shoulders are constructed, reconstructed, or overlaid as part of a highway construction contract and as a separate project for highways on which no reconstruction is scheduled in the near future. Shoulder rumble strips should not be installed where major surfacing work is scheduled or anticipated within the next three years.

Shoulder rumble strips will not be installed on rural highways which have a paved shoulder width of less than 4.0 feet, except as provided for the left, or median shoulder on rural Interstate and divided highways.

Shoulder rumble strips will not be installed within urban areas, where there is curb and gutter, where the highway posted speed is 45 mph or less, across bridge approaches and decks, or adjacent to guardrail if the clear path between the shoulder rumble strip and guardrail is less than 5 feet.

Interstate Highways: The rumble strips will be installed by milling a continuous pattern on both the right and left shoulders as summarized in Table 1. Shoulder rumble strips may also be installed on the right shoulder of Interstate loop ramps. Existing formed-in shoulder rumble strips on the shoulders, initially installed at about a 48-foot spacing, will remain in-place rather than installing new, continuous milled-in rumble strips.

Two-lane Highways and Multilane Highways: The rumble strips will be installed by milling an intermittent or continuous pattern on the shoulders as summarized in Table 1.

Bicycle Travel Considerations: The AASHTO Guide for the Development of Bicycle Facilities 1999, indicates a paved shoulder width of 4 feet to accommodate bicycle travel. Further, the guide indicates shoulder rumble strips are not recommended where shoulders are used by

bicyclists unless there is a minimum clear path of 1 foot from the rumble strip to the traveled way, 4 feet from the rumble strip to the outside edge of paved shoulder, or 5 feet to adjacent guardrail, curb, or other obstacle.

The NDDOT guidelines accommodate bicycle travel on two-lane and multilane highways as follows:

- For paved shoulders greater than, or equal to 6 feet, bicycle travel is accommodated between the rumble strip and outside edge of the shoulder. The shoulder rumble strip will have an intermittent design to provide bicyclists a chance to temporarily cross over in the travel way to avoid debris and object blocking the shoulder, and to make turning movements.

- For paved shoulders less than 6 feet, bicycle travel is accommodated along the outside edge of the edge of the travel lane. The shoulder rumble strip will have an a minimum offset of 12 inches from the travel lane and a continuous design.

- The width of the shoulder rumble strips have been narrowed to 12 inches.

- The rumble strips will be discontinued if the clear path between the rumble strip and guardrail or other obstruction is less than 5 feet.

- As shoulder rumble strips will require bicyclists to ride farther out from the vehicle induced wind-sweep shoulder edge, periodic sweeping as part of regular maintenance activities may be necessary to remove debris to safely accommodate bicycle travel.

Maintenance Considerations: The shoulder rumble strips may be covered during patching and overlay activities. A reasonable attempt should be made to reinstall the rumble strips, thereby maintaining the consistency of shoulder rumble strips on the highway. If it is not possible or feasible to maintain the rumble strips due to construction methods or insufficient shoulder width, the rumble strips should be discussed in the project concept report and a decision item included for approval. Alternative installation methods may be considered, such as using the rolled-in type of rumble strip. The rolled-in method may be useful for patching and overlay completed by district personnel.

The shoulder rumble strips may be covered during chip and sand sealing activities. The District Engineer may limit chips to the travel lanes only and sand the shoulders, or eliminate the chips or sand on the shoulders altogether.

The shoulder rumble strips milled into new or existing bituminous pavements will be fog sealed to protect the milled rumble strips from oxidation and moisture. The fog seal will consist of an application of SS-1h or CSS-1h at a rate of 0.10 gal/sy across the full width of the milled rumble strip. The District Engineer may eliminate the requirement to fog seal the rumble strips.

Table 1 - Types of Shoulder Rumble Strips

Highway Type	Shoulder	Shoulder Rumble Strip Types
Interstate	Right (Outside)	**Type 1 - 16" Continuous** Continuous milled rumble strips, 16" wide, located 2' from the edge of travel lane.
	Left (Inside/ Median)	**Type 1 - 16" - Continuous** Continuous milled rumble strips, 16" wide, located 1' from the edge of travel lane. *Install only when a 2' or greater paved shoulder width exists.*
Multilane, Divided	Right (Outside)	**Type 2 - 12" - Intermittent (40' milled strip/10' gap)** Intermittent milled rumble strips, 12" wide, located 1' from the edge of travel lane.
	Left (Inside/ Median)	**Type 2 - 12" - Continuous** Continuous milled rumble strips, 12" wide, located 1' from the edge of travel lane. *Install only when a 2' or greater paved shoulder width exists.*
Multilane, Undivided; Two-lane; Paved Shoulder $6'	Both (Rt &Lt)	**Type 3 - 12" - Intermittent (40' milled strip/10' gap)** Intermittent milled rumble strips, 12" wide, located 1' from the edge of travel lane.
Two-lane; Paved Shoulder, $ 4' and < 6'	Both (Rt &Lt)	**Type 4 - 12" - Continuous** Continuous milled rumble strips, 12" wide, located 1' from the edge of travel lane. *Installed only when documented ROR crash problem and little or no bicycle traffic is expected.*

See attached Standard Drawing D-960-2, revised date March 21, 2002, for section and plan views of shoulder rumble strips on shoulders and guidelines for appropriate breaks in the shoulder rumble strips for exit and entrance ramps, turning lanes, intersections, paved or graveled approaches and private drives, field drives, and scenic and historical marker turnouts.

Questions
Any questions regarding the content or implementation of this memorandum should be referred to Mark S. Gaydos, Design Division, 701-328-4417, or mgaydos@state.nd.us.

Approved

Francis G. Ziegler - Director, Infrastructure Support Services Date

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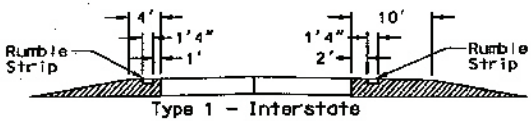
attachment
c: FHWA

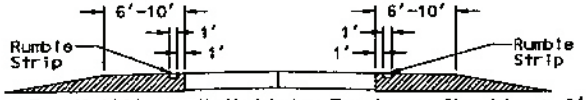
SHOULDER RUMBLE STRIPS

D-960-2



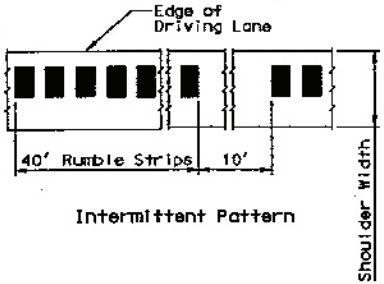
Type 1 - Interstate

Type 2 - Multilane, Divided

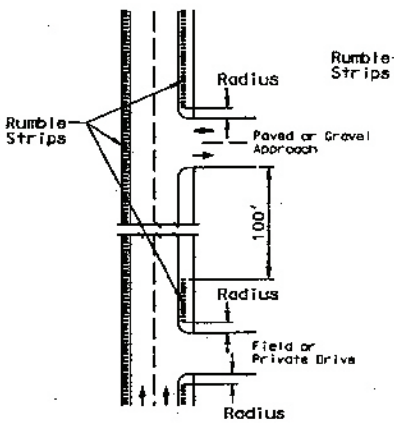


Type 3 - Multilane, Undivided - Two-Lane, Shoulder ≥ 6'

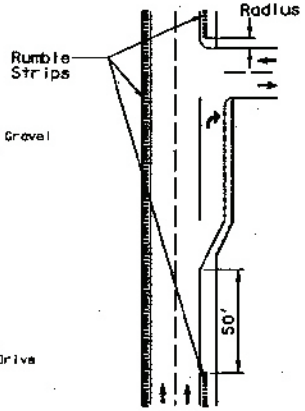
Type 4 - Two-Lane, Shoulder < 6'



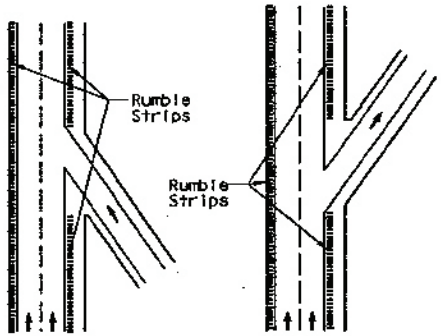
Intermittent Pattern



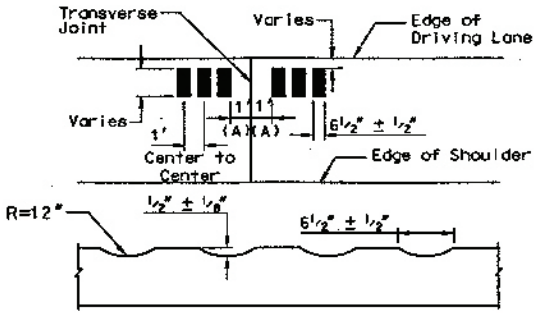
Entrance Roadways



Turn Lane (Right & Left)

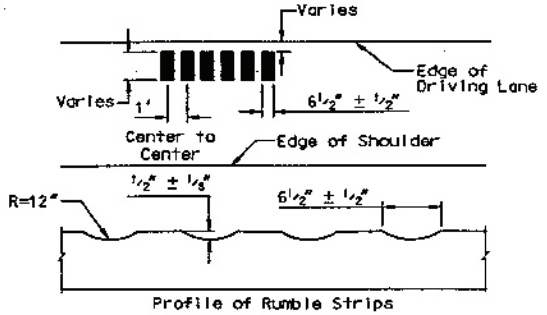


Entrance Ramp | Exit Ramp



Profile of Rumble Strips
PCC Pavement Detail

(A) Discontinue rumble strip approximately 1'-0" on both sides of transverse joint.



Profile of Rumble Strips
Bituminous Pavement Detail

NOTES:

1) Rumble strips shall be milled into the bituminous and concrete paved shoulders. The milled materials shall be swept off the entire width of the paved shoulder.

2) Rumble strips shall be discontinued across the entire length of turn lanes, turn lane tapers, ramp tapers, graveled & paved intersections, private drives, and field drives, as shown above.

3) The rumble strips milled into new or existing bituminous pavements shall be fog sealed across the full width of the milling with an application of SS-1h or CSS-1h emulsified asphalt at a rate of about 0.10 Gal/SY. All costs for fog sealing shall be included in the cost bid for rumble strips.

4) Discontinue rumble strips through all urban areas, where there is curb and gutter, highway posted speed is 45 mph or less, across bridge decks and approach slabs, and adjacent to guardrail if the clear path between the rumble strip and the guardrail is less than 5 FT.

PAY ITEMS:

When a bid item is included in the plans, the quantity for rumble strips is measured by project length for each shoulder per mile, and paid for by plan quantity. No deduction in length will be made for discontinued rumble strips as identified in note #2.

Rumble Strips - Concrete Shoulder	Mile
Rumble Strips - Asphalt Shoulder	Mile

3-12-01 REVISIONS	
DATE	CHANGE
03-21-02	General revisions
05-10-02	Revised note 3

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

APPROVED: _____ DESIGN ENGINEER

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